Abstract View

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On the Longshelf Structure and Dynamics of Subtidal Currents on the Eastern United States Continental Shelf

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ABSTRACT

Strong correlations were observed among subtidal longshelf currents from the Middle Atlantic Bight (MAB) to the Georges Bank region, a distance spanning 615 km. The longshelf current consisted predominantly of wind-forced motions and freely propagating events, which together accounted for 75%–90% of the longshelf current energy. Much stronger longshelf currents were observed in the MAB than on Georges Bank. The MAB/Georges Bank energy ratio for wind-forced currents on the 60 m isobath was 20. The ratio for freely propagating events was 3. The magnitudes of many of the terms in the vertically integrated wind-driven momentum equations were estimated from observations of current, pressure and surface stress, and from calculations of bottom stress. The cross-shelf momentum balance was geostrophic. Surface and bottom stress, the longshelf pressure gradient, and the Coriolis force on the cross-shelf flow were important terms in the longshelf momentum balance. An analytic model of wind-forced current, which incorporates the significant force balances, accounted for the observed longshelf variation of the wind-forced currents. Average bottom-drag and bottom-resistance coefficients estimated from current and bottom-stress records range from 4–8 ($\times 10^{-3}$) and 0.07–0.20 cm s^{-1}, respectively.

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